Task Title: Modeling Optimization Tools of MOI Technology

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Program initiation date: Program initiated as IA040 September 25, 2001 with scheduled ending date of September 25, 2002.

Objective:

- To develop a finite element code for simulating the eddy current MOI inspection geometry.
- To work with the industrial partner in the validation and application of the MOI inspection model for aviation applications.

Research Activities:

- Provide understanding of effect of layer thickness and air gaps between layers of MOI response
- Use model as experimental testbed for parametric studies varying bias fields, frequency, excitation level, industrial foil thickness as function of defect type/size
- Use prediction of magnetic fields to optimize imaging process
- Validate the model in cooperation with industry partners

Anticipated Results:

MOI is applicable to detection of corrosion and second layer cracking with large coverage area and easy-to-interpret images. Most research efforts have focused on improved hardware and electronics. Improvements are needed in MOI film sensors to lead to POD improvements. A numerical model for simulating physical processes helps make more informed design decisions.

Accomplishments:

May 2000: Completed initial model validation for simple crack and corrosion geometries.
September 2000: Attended ATA NDT Forum in SFO for discussion of the work with industry partners.
June 2001: Completed parametric studies for 1st layer corrosion (corrosion depth, diameter, frequency, effect of 2nd layer) and 2nd layer corrosion domes (corrosion on top and bottom of 2nd layer).
March 2002: Completed parametric studies of circumferential cracks in dimpled countersinks underneath rivet heads.

Publications:

R. Albanese, G. Rubinacci, A. Tamburrino, A. Ventre, F. Villone, L. Xuan, B. Shanker, and L. Udpa, ìA Comparative Study of Finite Element Models for Magneto Optic Imaging Applicationsî, ENDE 2001, University of Cassino, Italy, June 2001.
L. Udpa, W. C. L. Shih, and G. F. Fitzpatrick, ìImproved Magneto-Optic Sensors for Detection of Subsurface Cracks and Corrosion in Aging Aircraftî, Aging Aircraft 2001, The 5th Joint NASA/FAA/DoD Conference on Aging Aircraft, September 10-13, 2001, Hyatt-Orlando, Florida.
L. Xuan, Z. Zeng, B. Shanker, and L. Udpa, ìDevelopment of a Meshless Finite Element Model for NDE Applicationsî, ACES Conference, Monterey, California, March, 2002.